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GUIDed: Assisted-Living Smart Platform & Social Communication for Older Adults

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Problem Statement

- Reduced birth rates and increased life expectancy => restructuring of population demographics

- The share of older adults (65 or over) among the total population in the EU-28 in 2016 was 19.2%

- => Population aging + increased incidence of chronic disease + technological advances + the rapidly escalating health-care costs: driving healthcare from hospital and day care centers to home

Problem Statement

- Although many (disjoint) technological solutions and services are available: the ability of older adults to find, choose and combine such services is a critical issue
- While most older adults feel that technology makes a positive impact on society, almost three quarters lack confidence in their ability to use devices to complete online tasks
- Internet usage among older adults has increased over time
  - However studies have found that fear of technology is more prevalent in older generations who did not grow up with computers
- Many older adults are still perceived as being resistant to modern technologies

Problem Statement

Why?

- Technophobia
  - Can be found in older adults
  - Caused by anxiety about science or mathematical problems
  - People who feel intimidated by these subjects are more likely to experience technology anxiety
  - Older adults who face this phobia respond better if they get support from younger adults: children, grandchildren, local program officers
  - Young generation:
    - Assume the role of good mentors
    - Reward small steps taken by technophobic to overcome their fears
- The costs of devices and of Internet service also keep older people offline
- Physical limitations or cognitive impairment

Our solution: GUIDed

- GUIDed Assisted-Living and Social Interaction Platform (GUIDed)
- GUIDed AAL EU project: addresses the challenge of keeping older adults independent and functioning in their own homes for as long as possible
- How? By facilitating important activities of daily living through ICT solutions
- GUIDed uses:
  - A modular and customizable smart home platform
  - A backened system , and
  - An Android application consisting of assisted-living solutions and services
- AIM: to facilitate seniors' daily lives in their own home and the community

Our solution

- Main target areas are:
  - Smart home control
  - Home safety enhancement
  - City navigation
  - Nutrition and health improvement
  - Socialisation/communication

In this paper

- We present the GUIDed system and three of the five GUIDed services
- We report on our findings from the evaluation of the GUIDed High-Fidelity (Hi-Fi) paper prototypes for these services with primary end-users via focus groups
- The GUIDed Hi-Fi prototypes were tested by older adults and their caregivers in four European countries

Methodology

- A user-centred design approach was adopted
- Our Target group:
  - Primary end-users: Older adults living independently in their own homes with no or moderate need for assistance
  - Secondary end-users: Family members and informal caregivers
  - Tertiary end-users: Care organisations (day-care centres, hospitals, clinics, retirement homes, nursery homes) and staff (healthcare professionals)
  - Other: technology product vendors, telecare service providers, policy makers and the like.

Methodology Steps

1. Older adults' recruitment and analysis of the respective demands and needs
2. National strategies and governmental recommendations for Assistive Technologies were reviewed in Cyprus, Austria, Norway and Poland
3. Based on 1 and 2, the GUIDed platform and its services were then defined and presented to the primary end-users via workshops in order to collect their initial impressions
4. Based on 3, the platform and its services were defined and the specifications designed
5. Experimental evaluation and feedback activities commenced and continue

Testing Phases

- Testing phases for the experimental evaluation and feedback activities

Testing phase	Evaluation tool	Method to collect feedback
1	Paper prototype	Focus groups
2	Mock-ups (semi-functioning)	Questionnaires
3	First functional prototype	Living lab

- In this paper we present the results from the first Testing phase that includes the design of High-Fidelity (Hi-Fi) paper prototypes for three of the services, as well as their evaluation with primary end-users utilising focus groups

The GUIDed Platform
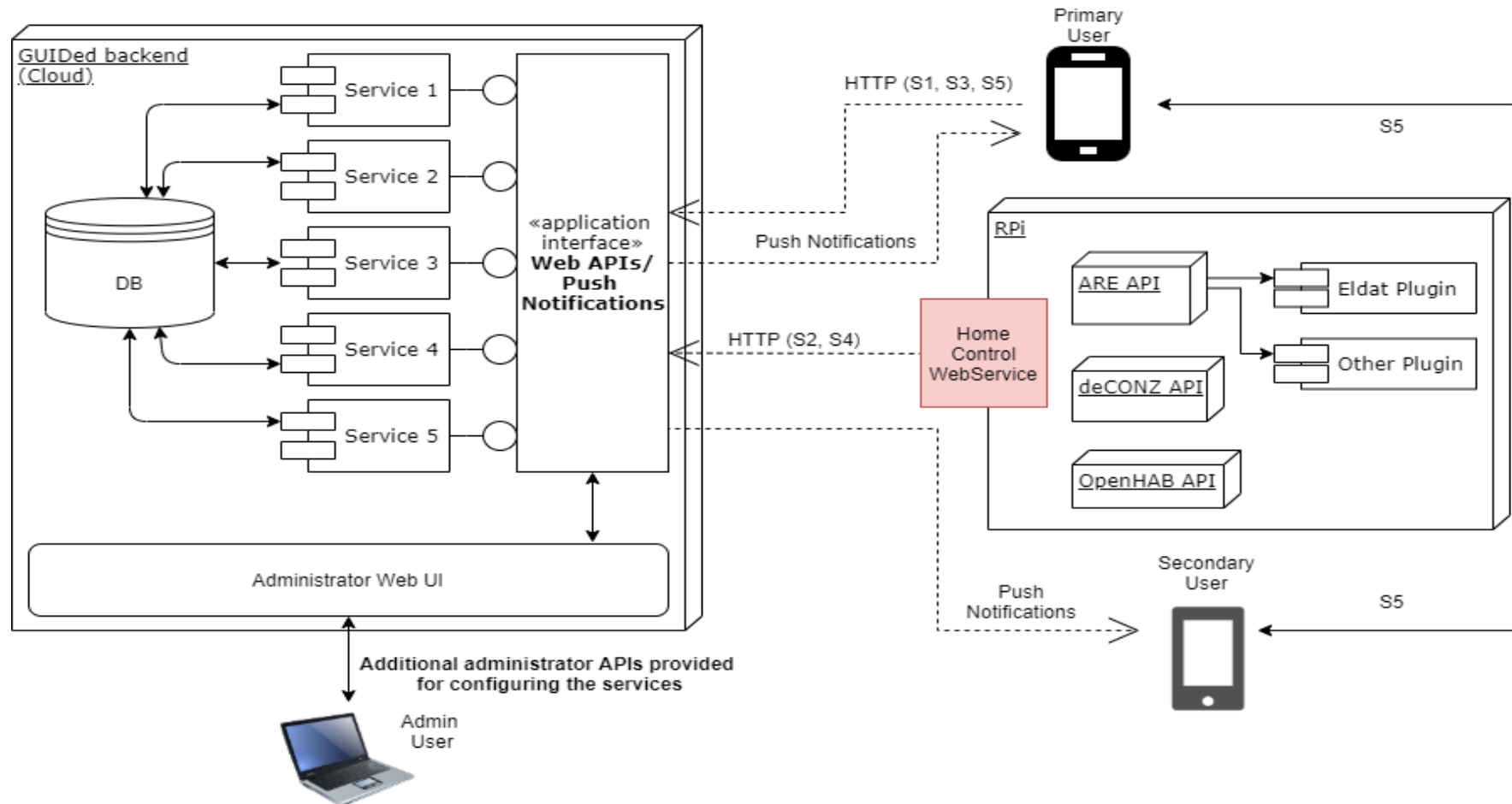
Backend: Drupal Platform

- Drupal: it is a scalable, modular, open platform for web development and content management
- Runs on any computing platform that supports both a web PHP server and a database (i.e., MySQL) to store content (i.e., data) and configuration information
  - Drupal – Content Management System (CMS): provides the web interfaces for entering end-user data, e.g., user profile, prescriptions, etc.
  - Drupal – MySQL Database (DB): stores end-user data entered from the CMS or through the Android app that interacts with the Drupal REST APIs
  - Headless Drupal – REST APIs: Headless Drupal is an approach in which Drupal serves as the backend content (i.e., data) repository. The frontend is built in different technologies and communicates with Drupal via REST APIs (i.e., HTTP requests, HTTP responses)

Smart Home Control and Safety

- Raspberry Pi:
  - Proprietary software (java spring application)
    - Configuration of smart home environment
    - Integrates existing open source software: ARE, OpenHAB
      - -> Extensibility to many smart home devices
  - Integration of the deCONZ control software for controlling ZigBee networks
  - Integration with the DigitalOcean cloud backend and Google Firebase
    - Send push notifications to linked users – e.g. "smoke alarm triggered"

Smart Home Control and Safety

- Example use case: smoke alarm triggered

GUIDed cloud server
(Google Firebase)

GUIDed cloud server
(DigitalOcean)

GUIDed smart kit hub
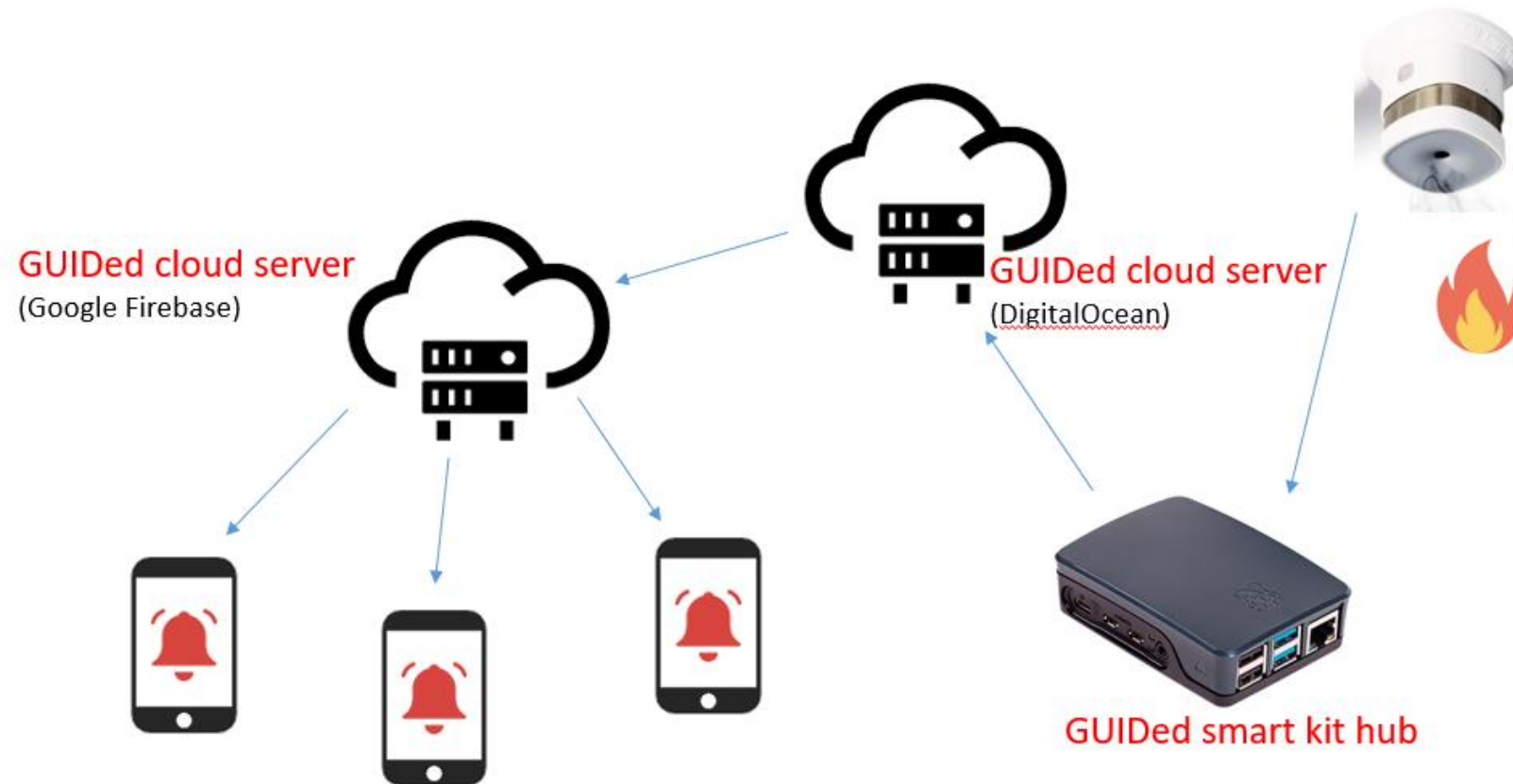
Smart nutrition and health service

- Drupal CMS provides a web interface.
  - Is used for entering end-user data, e.g., user profile, prescriptions, drugs

Integration – under development

HTTP request

HTTP response

Drupal – Headless REST APIs

MySQL DB

stored

GUIDed cloud server

GUIDed app – Android AR core

Smart Navigation Cloud Server

Integration – under development

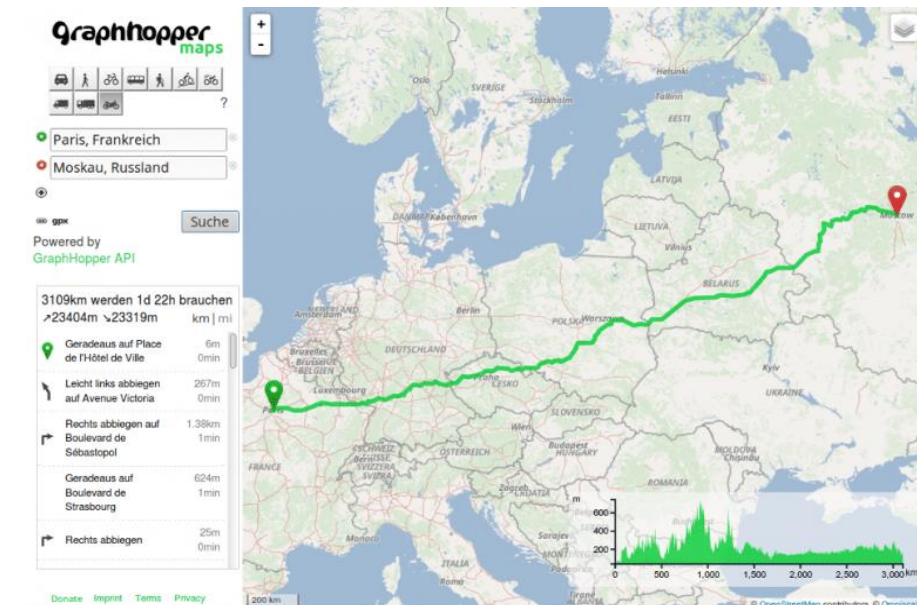◦ GraphHopper is an open-source routing library and server

HTTP request

HTTP response

Drupal – Headless REST APIs
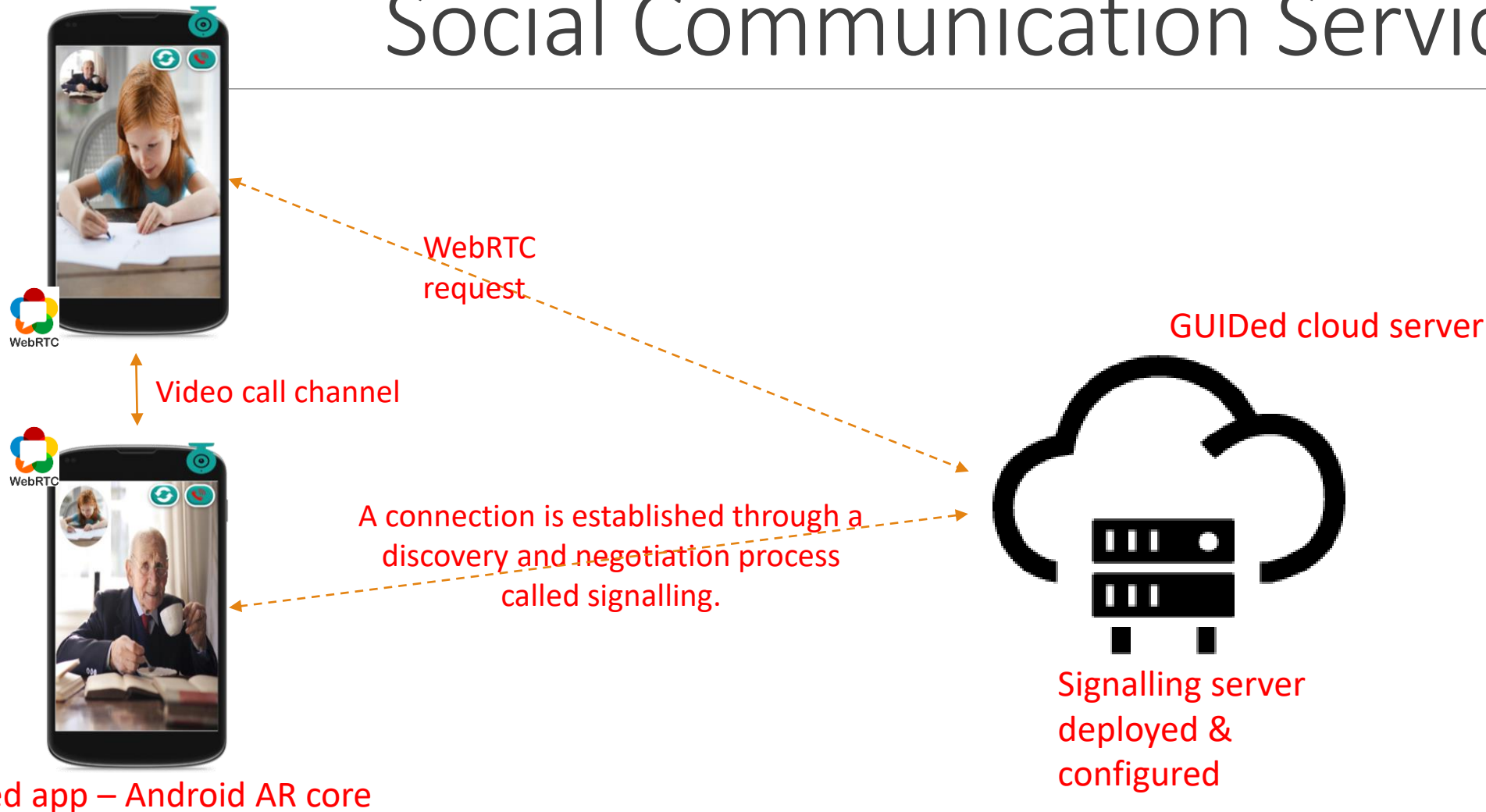
deployed & configured

GUIDed cloud server

- It also provides a "Google Maps" like web interface
  - Is used for testing GraphHopper configuration.

- It provides a routing API over HTTP

GUIDed app – Android AR core

Social Communication Service

WebRTC
request

GUIDed cloud server

Video call channel

A connection is established through a
discovery and negotiation process
called signalling.

Signalling server
deployed &
configured

GUIDed app – Android AR core

Results

- The GUIDed Hi-Fi prototypes were tested by older adults and their caregivers in Austria, Cyprus, Norway and Poland

- Due to the social distancing measures each end-user site implemented the testing via focus groups, one-to-one meetings or virtual meetings according to their resources and national restrictions at the time

- 39 older adults
  - Mean age=72.74, SD=9.12, range=59-94
  - 59% female
  - 41% had "little" technological literacy: they stated that used technological devices only sometimes

- 9 caregivers
  - Mean age=48.55, SD=10.05, range=34-64
  - 55.6% male
  - 44.4% had "great" technological literacy (stated that they used technological devices all the time)
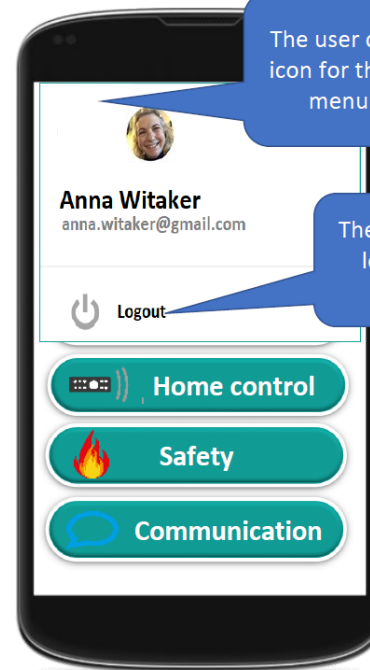
Main UI of the GUIDedApp

Log-in and log-out screens

Main UI screen design options
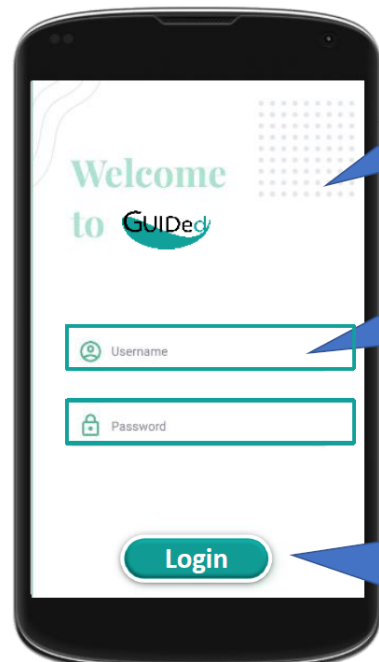
User account is created initially using the web interface (CMS).

User types username or email and password to login the first time.

The user remains logged in to the application unless he/she manually logs out.
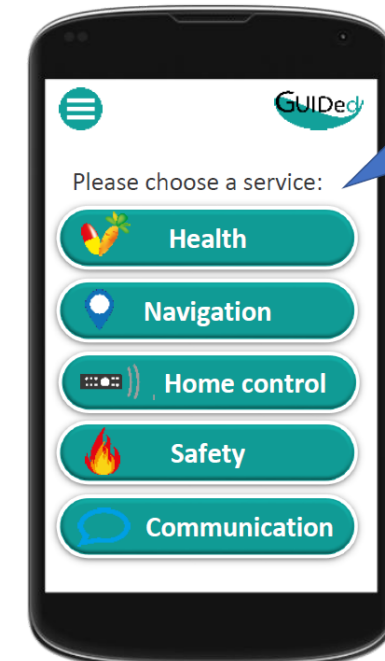
The user can click the icon for the extended menu to hide.

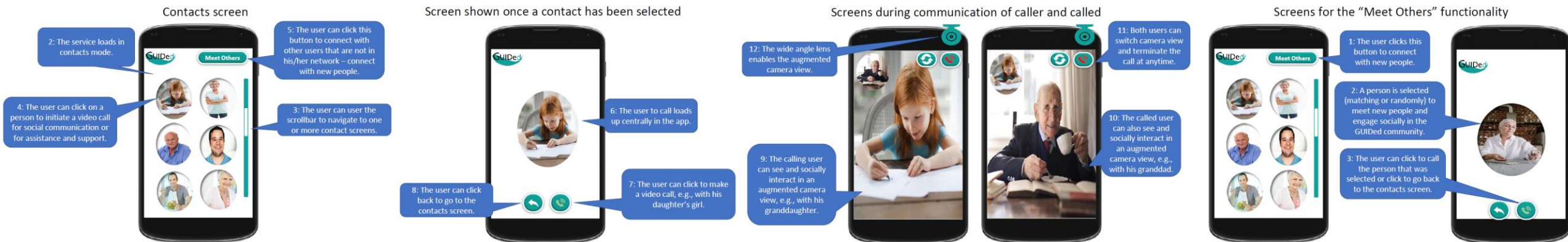The user can click to logout from the application.
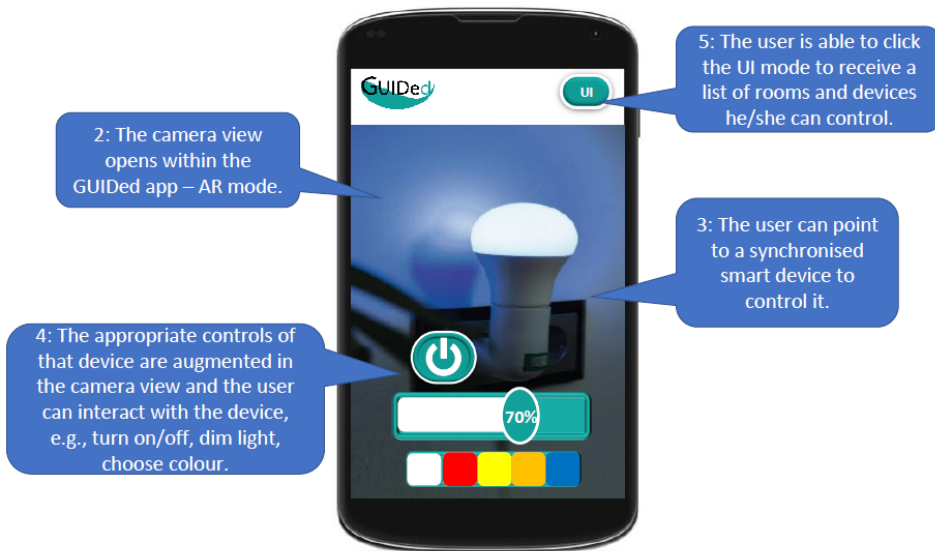
The main screen of the app is loaded.

The main screen of the app is loaded.

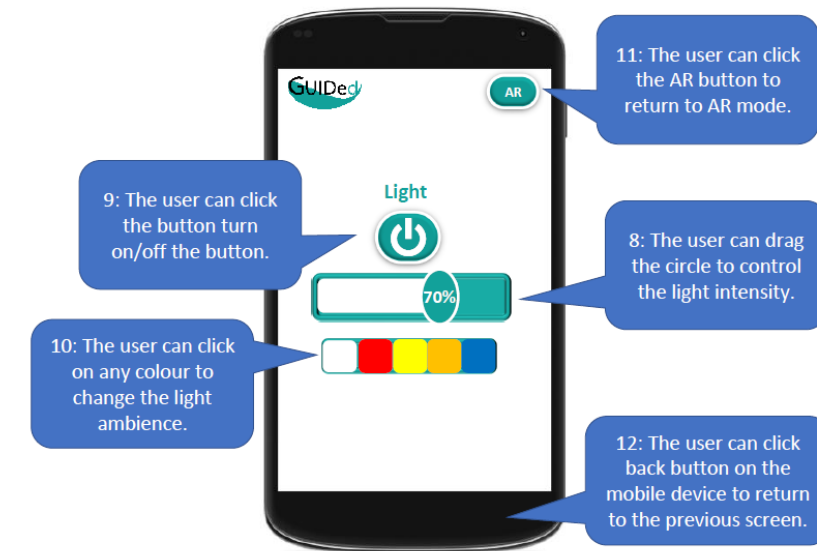# Social Communication Service

Smart Home Control Service

Screen shown once selecting this service

5: The user is able to click the UI mode to receive a list of rooms and devices he/she can control.

2: The camera view opens within the GUIDed app – AR mode.

3: The user can point to a synchronised smart device to control it.

4: The appropriate controls of that device are augmented in the camera view and the user can interact with the device, e.g., turn on/off, dim light, choose colour.

Screen to view the rooms of the home

6: The UI view opens within the GUIDed app.

7: The user can click in any room (e.g., Living Room) to access it's smart devices.

Screen to control a smart device (e.g. light)

11: The user can click the AR button to return to AR mode.

9: The user can click the button turn on/off the button.

8: The user can drag the circle to control the light intensity.

10: The user can click on any colour to change the light ambience.

12: The user can click back button on the mobile device to return to the previous screen.
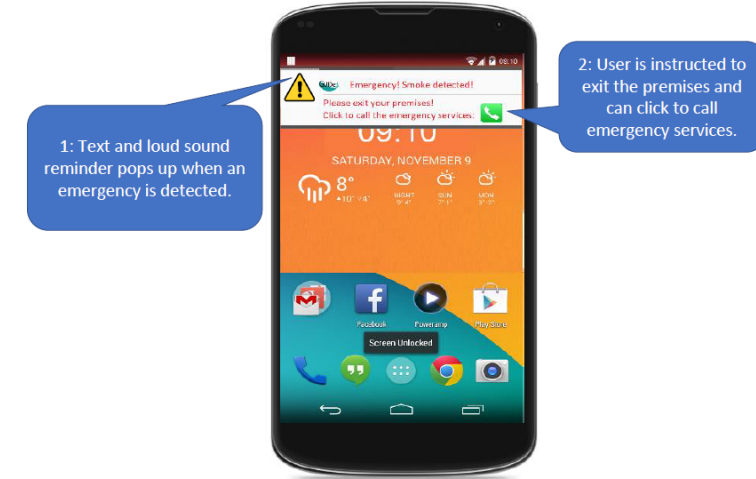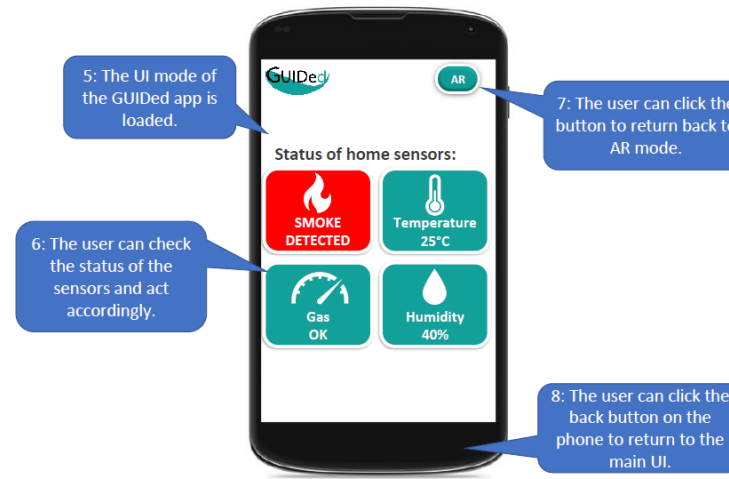
Smart Home Safety Service

Screen to view the status of a smart home safety device by pointing camera to it

Screen to view the status of all the smart home safety devices via the UI

Emergency notification and instructions sent to the end-user

4: The user can click the button to enter UI mode.

2: The camera view opens within the GUIDed app – AR mode.

3: The user can point to a synchronised smart sensor device to retrieve its status.

5: The UI mode of the GUIDed app is loaded.

7: The user can click the button to return back to AR mode.

6: The user can check the status of the sensors and act accordingly.

Status of home sensors:

SMOKE DETECTED

Temperature 25°C

Gas OK

Humidity 40%

8: The user can click the back button on the phone to return to the main UI.

1: Text and loud sound reminder pops up when an emergency is detected.

2: User is instructed to exit the premises and can click to call emergency services.

Results of the Hi-Fi prototype testing

- All users found the GUIDed app understandable and easy to use -> encouraging considering older participants' low technological literacy
- Suggestions for improving usability:
  - Increasing the contrast of the screen colours and taking under account colour blindness when choosing the palette
  - Changing the labels of some buttons (e.g., replacing the term 'user interface' with something more intuitive)
  - Replacing some of the icons with more appropriate ones
- Intuitive and easy to use but introductory training for support is needed
- Training component: innovative assistant utilising augmented reality technology

Results of the Hi-Fi prototype testing

- Most participants showed a preference towards user interface design with tiles: it seemed cleaner with larger buttons than the other design
- Remark: all tiles referring to individual services should be the same size: not underestimating the importance of any service

Main UI screen design options
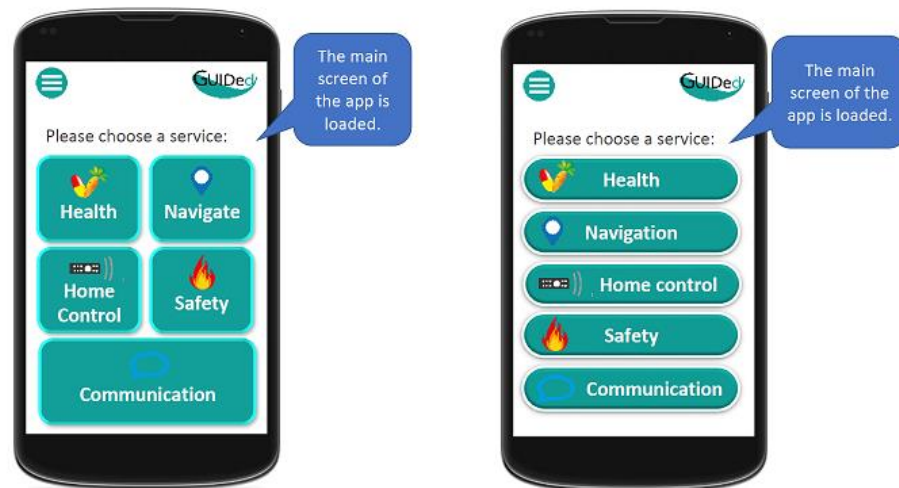
Results of the Hi-Fi prototype testing

- Participants valued all of the services included in the GUIDed app
- As they stated, the GUIDed app combines "all important services in one" constituting it an "everyday life companion" and "assistant"
- Two of the services rated as most useful included the Smart Home Control service and Smart Safety service as they simplify everyday procedures and offer convenience and safety, respectively
- Some participants valued less some of the services due to personal lifestyle preferences
  - For example, older adults who did not take medication stated that they would not use so much the Health and Nutrition service
- All participants provided recommendations for additions and improvements in order to suit their individual needs
  - E.g., participants requested the addition of an emergency button in the GUIDed app home screen to provide an easy means to call for help in case of an emergency

Results of the Hi-Fi prototype testing

- Smart Nutrition and Health service: participants requested the addition of a reminder to measure their blood pressure or sugar levels and fields to insert those measurements in the app
- Smart City Navigation service: participants requested the implementation of voice guidance apart from visual notifications as it seemed easier for them to have auditory assistance while walking around.
- Smart Home Control service: helpful to have the ability to control their TV or front door
- Smart Home Safety service: Incorporation of anti-theft devices
- Social Communication service: simplification of the calling process
  - e.g., a call should be initiated when the user touches the photo of a contact stored in the app

Results of the Hi-Fi prototype testing

- The feedback collected in Phase 1 is under review
- This process will lead to preparing for the second Phase of testing
- Consortium next steps:
  - Improve the designs of the services accordingly
  - Use mock-ups to be evaluated by the end-users using questionnaires

Acknowledgments

Thank you!

Questions?

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